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Energy, Mines and Resources Canada
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Development of a Strategic Plan for Bioenergy Division Information and Technology Transfer

Prepared for:

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Renewable Energy Branch
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EXECUTIVE SUMMARY

The objective of the study which is presented in this report was to develop a strategic plan for information and technology transfer in the Bioenergy Division (BED) of the Renewable Energy Branch. Information on which the study's findings were based was obtained from a literature search, from available studies from within Energy, Mines and Resources Canada (EMR) and from interviews with officials within EMR and other federal government departments.

In the study a broad view of what constitutes "technology transfer" was taken, based on the following definition:

> Technology transfer is the process of facilitating the commercialization of a potential application of technology.

With this view, it became clear that the overall mandate of the Bioenergy Division - to increase the utilization of bioenergy where technically and economically feasible - consists of technology transfer initiatives. These initiatives are oriented toward overcoming barriers faced by designated technologies in moving through the basic stages of the commercialization process: opportunity identification, R&D, trial demonstration, market introduction and market penetration. More specifically, it is suggested that the role of the Division is to shepherd selected technologies through to

the stage of market acceptance. Technologies to be supported should be those for which a large enough potential market application exists to justify a business investment to supply the product upon its successful completion of R&D and demonstration stages. Thus, the focus of the Division should not be simply on bioenergy technologies; rather, the focus should be on prospective applications of technology (or PATs). The planning process to develop a strategic plan for technology transfer within the Bioenergy Division thus consists of a process to identify the set of PATs that are most appropriate to support and to determine the most cost effective mechanisms for overcoming the barriers each selected PAT faces in the developmental and market acceptance phases of the commercialization process.

Information transfer is a subset of activities within technology transfer and consists of communications initiatives that address specific awareness and attitudinal barriers that may exist at any of the stages of the commercialization process.

The steps to develop a strategic plan for information and technology transfer within the Bioenergy Division are outlined in Figure ES-1. These steps begin with the preparation of a brief by BED management that establishes areas of strategic interest (similar to the approach taken in the "Strategic Plan for Bioenergy R&D" issued in January, 1987). Next, BED officers

develop a preliminary technology transfer plan for PATs which meet BED strategic priorities. Each PAT plan first documents the current situation and then recommends a set of appropriate TT activities. These individual PAT plans are then reviewed by BED management and rationalized to form an overall technology transfer plan for the Division. Upon completion of detailed TT plans for selected PATs, the information transfer plan is then developed by BED officers and the Information Transfer Group based on the communications requirements of the plan for each technology application as well as the Division as a whole.

In summary, this study determined that the development of a strategic plan for information and technology transfer for the Bioenergy Division is synonomous with the planning process for the Division's overall set of activities. Information and technology transfer were found to be the core of, and not an adjunct to, the mission of the Division. Implementation of the recommended planning process should enhance the ability of BED management to create a clear sense of direction for the Division and contribute to greater efficiency and effectiveness of day-to-day operations.

Figure ES-1

Steps to Develop a Strategic
Plan for BED Technology Transfer

i) Establish Areas of Strategic Interest (BED Management)

ii) Document PATs Meeting BED Strategic Priorities (BED Officers)

- Description of the Current Situation (players, stage of commercialization, market opportunity, barriers)
- Preparation of the Preliminary Plan for TT Activities (objectives, activities, resources)

iii) Select PATs for Support (BED Management)

iv) Develop Detailed Plan of TT Mechanisms for PATs to be Supported (BED Officers)

v) Prepare Information Transfer Plans (BED Officers and ITT Group)

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RÉSUMÉ

Le rapport qui suit présente l'étude de l'élaboration d'un plan stratégique de diffusion des connaissances et des techniques pour la Division de bioénergie, Direction des énergies renouvelables, ministère de l'Énergie, des Mines et des Ressources (EMR). L'étude a été fondée sur une recherche bibliographique, les études obtenues d'EMR et les entrevues des représentants d'EMR et d'autres ministères fédéraux.

On a adopté une acception élargie de la "diffusion des techniques" en fonction de la définition suivante :

> La diffusion des techniques consiste à faciliter la commercialisation d'une application possible de ces techniques.

Selon cette acception, la mission globale de la Division de bioénergie -- accroître l'utilisation de la bioénergie lorsque cela est faisable sur les plans technique et économique -- se traduit manifestement par des mesures de diffusion des techniques. Ces mesures visent à surmonter les obstacles qui empêchent certaines techniques de franchir les étapes fondamentales de la commercialisation : reconnaissance des possibilités, recherche-développement (R-D), démonstration d'essai, lancement sur le marché et pénétration du marché. Plus précisément, on donne à la Division le rôle de guider le cheminement de techniques choisies jusqu'à l'étape de l'acceptation par le marché. La Division devrait appuyer, une fois terminées les étapes de R-D et de démonstration, les techniques dont les perspectives de marché sont assez vastes pour justifier l'investissement dans la fabrication du produit. Ainsi, la Division ne devrait pas concentrer ses efforts sur les techniques bioénergétiques, mais plutôt sur les applications possibles des techniques. La planification relative à l'élaboration d'un plan stratégique de diffusion des techniques au sein de la Division de bioénergie consiste donc à reconnaître l'éventail des applications qu'il convient le mieux d'appuyer et à déterminer les moyens les plus rentables de surmonter les obstacles qui entravent la mise au point et l'acceptation par le marché de chaque application retenue.

La diffusion des connaissances forme un sous-ensemble d'activités de la diffusion des techniques. Elle consiste en opérations de communication destinées à sensibiliser les groupes cibles et à corriger certaines attitudes au cours de n'importe quelle étape de la commercialisation.

La figure ES-1 expose la marche à suivre par la Division de bioénergie pour élaborer le plan stratégique de diffusion des connaissances et des techniques. D'abord, les cadres de la Division rédigent un mémoire dans lequel ils déterminent les secteurs d'intérêt stratégique. La démarche est analogue à celle adoptée pour le plan stratégique de R-D en bioénergie qui a été diffusé en janvier 1987. Ensuite, les membres de la Division élaborent les plans préliminaires de diffusion des techniques pour les applications possibles correspondant aux priorités stratégiques définies. Chaque plan expose la situation actuelle et propose une série d'activités pertinentes de diffusion des techniques. Les cadres de la Division examinent les plans et les rationalisent pour établir le plan d'ensemble. Une fois que les plans détaillés sont achevés, les membres de la Division et le groupe chargé de la diffusion de l'information établissent un plan de diffusion des connaissances fondé sur les besoins en communications qui ressortent des plans relatifs à chaque application, ainsi que du plan d'ensemble de la Division.

En bref, l'étude établit que l'élaboration d'un plan stratégique de diffusion des connaissances et des techniques pour la Division de bioénergie coïncide avec la planification de l'ensemble des activités de la Division. La diffusion des connaissances et des techniques constitue l'essence de la mission de la Division et non une activité accessoire. La mise en oeuvre du processus recommandé de planification devrait accroître la capacité des cadres de la Division de donner à celle-ci une orientation claire, ainsi que contribuer à l'efficacité et à l'efficience des activités courantes.

1. INTRODUCTION

1.1 Background

The Bioenergy Division (BED) of the Renewable Energy Branch of Energy, Mines and Resources Canada supports many activities in the areas of research and development, demonstration and information transfer. Since 1984, the Division has seen its level of funding decline, particularly as the Forest Industry Renewable Energy (FIRE) Program has been phased out. At the same time, the mission of the Division has continued to be the promotion of the development of bioenergy in Canada as a technically and economically viable alternative energy source. Furthermore, the stated objective of doubling the contribution of bioenergy to the nation's energy needs between 1978 and 1990 has also been maintained.

In seeking ways to achieve the greatest degree of leverage for the limited BED staff and financial resources available, BED is paying increased attention to information transfer activities rather than to direct funding. During the past year, for example, a series of seminars and workshops has been sponsored to facilitate the exchange of information and to increase awareness in a range of topics related to bioenergy developments. In addition, a variety of efforts have been undertaken to develop and "package" useful information, including assessments of market potential, literature reviews, technical bulletins and case histories of energy projects.

However, the number and types of these kinds of information transfer activities are almost limitless. Many products and technologies could be involved, with communications directed to a very large number of target audiences through a wide array of available vehicles and activities. Also, the linkages between activities of the Information and Technology Transfer Group of BED and the R&D and demonstration initiatives have not been clearly identified and many communications activities have been undertaken on an ad hoc basis. Thus, in order to ensure the most efficient and effective use of available Bioenergy Division resources, it is seen as necessary to develop a more systematic approach to the management of information transfer and related technology transfer activities.

1.2 Project Objective

The objective of this project was:

To develop a strategic planning process for information and technology transfer for the Bioenergy Division.

1.3 Methodology

This project was carried out in three basic steps: i) information gathering; ii) analysis; and iii) report preparation and presentation. Information was obtained from several sources:

- Available studies and reports within Energy, Mines and Resources Canada.

- Pertinent studies and reports identified in a literature search of the major relevant data bases.
- Telephone and personal interviews with officials in other federal government departments.
- Personal interviews with managers and others in the Bioenergy Division.

A list of sources of information is provided in Appendix 1 to this report.

The analysis step of the project involved the distillation of the information obtained and the development of an approach that was conceptually sound and relevant to the mission, objectives and overall strategy being pursued by the Bioenergy Division.

1.4 Organization of This Report

Section 1 of this report contains a discussion of the general background to the project and a statement of its objectives. In Section 2, the BED strategic framework within which information and technology transfer take place is developed and definitions of key terms are presented. In Section 3, the conceptual approach to developing a strategic plan for BED information and technology transfer is discussed. Section 4 presents the outline of a workplan for the preparation of a strategic plan while, in Section 5, the implications of implementation of this approach on the resources and organizational structure of the Bioenergy Division are discussed.

2. FRAMEWORK FOR DEVELOPMENT OF A STRATEGIC PLANNING PROCESS

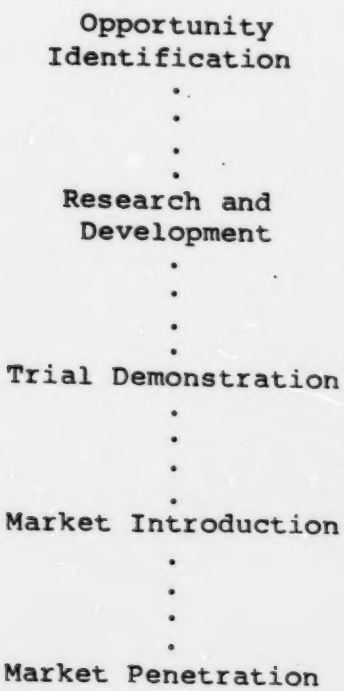
The activities currently referred to as information and technology transfer projects are carried out as part of the overall set of activities undertaken by the Bioenergy Division in the execution of its mission. Thus, at the outset of this study it was necessary to establish a clear understanding of BED's statement of mission and operational strategies. Clear definitions of terms were required, (especially that of "technology transfer"), since these have been found to be used in a variety of ways within the Division as well as throughout the literature.

2.1 BED Mandate and Strategy

The mandate of the Bioenergy Division is to increase the utilization of bioenergy in Canada where technically and economically feasible in a safe and environmentally appropriate manner. The rationale for government intervention (i.e., BED program initiatives) is based on the premise that such intervention will accelerate, in a cost effective manner, the process of developing and gaining acceptance for new biomass-related technologies in the marketplace. This technology development process is usually referred to as the commercialization process. The steps of this process, illustrated in Figure 2-1, are found to be very similar in most

Figure 2-1

Commercialization Process for a New Technology



literature reviewed. Appendix 2 contains examples of two such commercialization models utilized in reports prepared for the Renewable Energy Branch.

In this process, ideas for new technological opportunities are first identified. The first "Go/No Go" decision to be made is whether or not R&D should be undertaken in order to develop a new product or process in an attempt to exploit an identified opportunity. Within the R&D phase, a new technology may face a series of "Go/No Go" decisions depending on the results of each stage of R&D work. The next decision in the commercialization process is the commitment required to implement a trial demonstration of the technology in a realistic market application. Based on the findings of this trial, the decision to introduce the product to the market will be made. Commitments to support market penetration initiatives to accelerate the take-up by the potential segment of customers are predicated on the outcome of the market introduction efforts.

The general strategy which has been employed by the Bioenergy Division is based on the provision of assistance at the stages of the commercialization process. The Bioenergy Development Program (BDP), for example, supports a broad range of R&D projects. Demonstrations of technologies that have proved successful at the R&D stage are also supported. The use of financial incentives, such as the FIRE contribution grants which are no longer available, can be seen to relate to the market penetration stage of the commercialization process.

Information transfer initiatives can be associated with all steps of the commercialization process. The Bioenergy R&D Conference, for example, is a forum for communication among participants in bioenergy R&D projects. Results of demonstrations are documented and distributed to interested parties. Work on standards can facilitate the market introduction of safer bioenergy technologies while workshops and seminars can support the diffusion of a technology at the market penetration step.

It is critical to recognize that the commercialization process is a market-oriented process. The rationale for supporting a product being developed and demonstrated is based on the expectation that a market opportunity exists for the product. Such a market opportunity is characterized by a sufficient level of potential demand to warrant the establishment of a viable business to supply the product. At the early stages of the commercialization process, only preliminary estimates of the size of the potential market and the economics of establishing a business operation to supply the product are possible. Such estimates must be made, however, to ensure that the decisions as to which products should receive BED support reflect those with the greatest chance of contributing to the realization of the BED mandate.

2.2 Definitions of Key Terms

With the focus of attention of the Bioenergy Division on the ways to accelerate the commercialization of bioenergy technologies, it is important to establish a common base of understanding for key terms.

i) Technology

The stock of knowledge of industrial arts which includes design, installation, operation, repair and maintenance know-how as well as the application of scientific theories and laws to apparatus and systems.

ii) Prospective Application of Technology (PAT)

Within the range of resource procurement and conversion technologies in the bioenergy field, the commercialization process consists of a progression of developmental steps leading to the successful acceptance of the applicable technology as a viable alternative for meeting a set of market requirements. Thus, the focus should be placed at the earliest step on defining the prospective application of technology (PAT) being supported. A PAT can be defined as: Combination of renewable energy resource (such as wood waste), conversion technology (such as automated wood chip combustion) and a market application (such as residential buildings).

iv) Technology Transfer

The process of facilitating the commercialization of a prospective application of technology (PAT). This process is completed upon the commencement of use (without artificial support) of the developed or available technology (knowledge, know-how, equipment, systems) in designated market applications.

v) Information Transfer

The process of communication of information relevant to the commercialization of a technology application.

From this set of definitions, which are based on a broad view of what constitutes technology transfer, it can be seen that the overall mandate of the BED consists of technology transfer, i.e., the support (or "shepherding") of PATs from the idea stage through to widespread market acceptance.

2.3 The Marketplace for a Potential Application of Technology

In order to guide a PAT from the idea stage through to market penetration, it is necessary to understand the market dynamics within which the PAT is to gain acceptance. Market dynamics consist of the interplay of compatible and competing interests of several types of players, depicted in Figure 2-2. These players represent the participants - besides BED - in the commercialization process. Research and development can take place at universities, research institutes and other

Figure 2-2

Outline of Market Players for a Technology Application

earch oratory	Manufacturers Existing and New Products	Deliverers and Facilitators	Potential Customers
versity A	Company X	- Wholesale/Retail Trade - Consulting Engineers	Energy users characterized by:
pany B	Company Y	- Contractors - Financial - Trade Associations	- Proximity to renewable resource - Institutions - Size of energy requirements
titute C	Company Z	- Regulatory Bodies - Standards Associations - Other Groups	- Type of energy requirement (e.g., high pressure steam) - Other factors

organizations such as government laboratories. Manufacturers produce and market the equipment or systems which incorporate the technology. The new product may have been developed by the company, the rights may have been licensed or the company may have gained access to the product in other ways. Manufacturers of new products compete with manufacturers of existing products.

A group of energy users represents the potential customers for the product. These users may be defined on the basis of several criteria, such as the availability of the renewable resource to the facility and the size and nature of the energy requirements.

The linkage between manufacturers and potential customers that results in the purchase of the product is accomplished by a group of delivery agents and facilitators. Examples of delivery agents include wholesale/retail distribution outlets (selling a product such as wood stoves) or consulting engineers, who specify a product in a facility design. Facilitators might include financial institutions which provide capital funds and regulatory and standards groups which determine particular aspects of product acceptability.

Two illustrations of the market place for BED technology applications are shown in Figures 2-3 and 2-4. Figure 2-3 outlines the marketplace for high efficiency residential wood stoves while Figure 2-4 provides an overview of the marketplace

Figure 2-3

Illustration* of Market Players for

High Efficiency Residential Woodstoves

esearch aboratory	Manufacturers	Deliverers and Facilitators	Potential Customers
Wood heating laboratory at Ryerson Corning Glass laboratory (catalytic combustors) CANMET	. Elmira . Haughs Products . Osborne . Heritage	Wholesale/Retail Trade . Distributors . Chains, Groups . Stove Retailers Standards/ Certification . CSA . ULC . Warnock/Hersey Regulatory Bodies . Building Codes . Fire Marshalls . Fuel & Safety Branch Facilitators . BED . Consultants . Banks Associations . CWEI	Homeowners Characterized by: - Access to wood - Safety concerns - Replacement decision

Examples of each type of player are provided.

Figure 2-4

Illustration* of Market Players for

Anaerobic Digestors

Research Laboratory	Manufacturers	Deliverers and Facilitators	Potential Customers
Univ. of Guelph	Licensors of Technology: CSM, Netherlands	**Sales Agents**	Food & Beverage Plants including:
ADI Limited		Canviro	- Cheese Plants
Environment Canada		**Wholesale/Retail Trade**	- Breweries
		Not applicable	- Potato Processing Plants
		Standards/ Certification	
		Not a factor	
		Regulatory Bodies	
		. Provincial Environment Ministries	
		Facilitators	
		. BED	
		. Consultants	

* Examples of each type of player are provided

for a different bioenergy technology application, anaerobic digestors.

As is evident from these two illustrations, the important players in the marketplace within which individual technology applications are developed, produced and marketed can vary considerably. For each PAT under consideration, it is necessary to identify and understand the roles of the players who make or influence decisions that ultimately determine the rate at which energy users in a particular marketplace purchase a new or available bioenergy product. These decision-makers include the potential purchasers of the technology application whose awareness levels, attitudes and behaviour must be influenced in order to secure the eventual adoption of the new product. Thus, in planning for an R&D activity, it is necessary to anticipate and provide an initial definition of the marketplace for a technology application under development. Without such a preliminary forecast, the size of market potential and the barriers facing adoption of the technology may be seriously overestimated (leading to a technically sound product with no sales prospects) or underestimated (leading to failure to provide sufficiently vigorous support for a product with significant sales prospects).

It is important to note that the primary role identified for the Bioenergy Division as a market player is that of a facilitator. In other words, the shepherding of a PAT by the

Division is essentially a facilitative rather than participative role. It should also be noted that facilitators, standards bodies, regulatory groups and associations can be active at any one of the stages of the commercialization process for a PAT.

2.4 "Product-Oriented" Technology Transfer

The characterization of BED's mandate as the shepherding of PAT's through the commercialization process has been termed the "product-oriented" technology transfer (TT) approach in a 1984 report prepared for the U.S. Department of Energy's Conservation and Renewable Energy Technology Transfer Working Group. The product-oriented approach is described below. The report, prepared by Arawak Consulting Corporation, also identified two other technology transfer approaches, which are described in Appendix 3.

As stated on page 19 of the Arawak report: "The objective of the product-oriented technology transfer model is to transfer a technology, product, process or body of focused information whose application will result in greater energy efficiency or increased use of renewable energy." The product-oriented approach is used when the opportunity for a specific technology application has been identified and the commitment made to accelerate its development, availability and adoption.

There are two phases of technology transfer in the product-oriented TT approach. In the first, development of the technology application is taken through the research and

development and demonstration stages to the point where manufacturers make commitments to produce and market the product. In the second phase, the technology is adopted (i.e., the product is fabricated and installed) among the target group of energy users. Through these two stages, the TT efforts may be directed at researchers, manufacturers, facilitators, delivery agents and user groups. The purpose of all these efforts, however, is single-minded: To promote the adoption of a specific technology application.

Even though the Bioenergy Division has administered grant programs to users, supported the establishment of safety standards and certification procedures and carried out many other activities, all have stemmed from the objective of broadening the acceptance of safe, clean, viable biomass energy systems. Since the Bioenergy Division has oriented itself to the product-oriented technology transfer approach, it is clear that the "constituents" of the Division are the prospective applications of technology. Relationships with research organizations, facilitators, energy user groups and others are established as the means of providing support for PAT's and not because of an inherent interest in the groups themselves.

2.5 Technology Transfer Mechanisms

A broad range of technology transfer mechanisms are available to the Bioenergy Division as ways to support PAT's. A listing of these mechanisms, is presented in Table 2-1. This

Table 2-1

Technology Transfer Mechanisms

1. R & D Support

   - Co-operative
   - Sub-Contract

2. Demonstrations

   - Test Case
   - Show Case

3. Personal Interaction

   - Advisory Committees
   - Conferences, Seminars
   - Industry/Govt. Exchange
   - Visits

4. Information Preparation

   - Market Assessments
   - Technical Bulletins, Reports
   - Videotapes

5. Information Availability

   - Computer Network
   - Data Banks
   - Information Dissemination

6. Information Delivery

   - Education/Training
   - Direct Mail
   - Radio/TV
   - Journal Articles
   - News Releases

7. Guidelines/Standards

8. Financial Incentives

   - Grants/Contributions
   - Tax Incentives
   - Loan Guarantees

listing is based on a second U.S. Department of Energy report "Technology Transfer for DOE's Office of Building and Community Systems: Assessment and Strategies", Oak Ridge National Laboratory, July, 1986. A summary of the advantages, disadvantages and most appropriate situations for use for these mechanisms is presented in Appendix 4.

3. PLANNING PROCESS FOR A PROSPECTIVE APPLICATION OF TECHNOLOGY

With a variety of mechanisms available, a planning process for individual PATs is required and is developed in this section. The process by which plans for PATs are integrated into a plan for the Division is presented in Section 4.

3.1 The Management Process

The characterization in Figure 2-1 focuses on the implementation of the activities associated with each stage of the commercialization process. These activities, however, must be planned. Planning represents one step in the generic management process of plan/implement/evaluate. Thus, the progression from one stage of the commercialization process to the next involves an evaluation and planning component of activity that is, in many respects, even more critical than the implementation activity. Put simply, without the preparation of an acceptable plan of action, no approval for commitment of resources will be received and no activity will occur at a subsequent stage of commercialization. Figure 3-1 illustrates the linkage of evaluation/planning and implementation phases of commercialization stages.

The technology transfer mechanisms available to support a PAT can apply to either implementation or evaluation/planning phases. For example, a technical bulletin produced by an R&D project is usually associated with the R&D implementation

Figure 3-1

Linkage of Evaluation/Planning and Implementation Phases for the Stages In the Commercialization Process

Implementation Activity	Evaluation/Planning Activity
Opportunity Identification	
	R&D Planning
Research and Development	
	Demonstration Planning
Trial Demonstration	
	Business Planning
Market Introduction	
	Business Planning
Market Penetration	

activity. However, its primary value in technology transfer terms comes in contributing to the development of demonstration plans. By providing technical and economic evidence to potential participants that the technology is ready for demonstration, such a technical bulletin can provide credibility to those organizations providing resources.

It should be noted that the output of one stage of BED support activity (such as the preparation of a technical bulletin upon completion of an R&D project) may also be an input to another (coordination of planning for a demonstration). If the role (input and/or output) for an information transfer activity is not clearly understood, the brief which guides its preparation will be incomplete and its usefulness greatly limited.

Much of BED's involvement has historically been in the R&D and demonstration stages. For these, BED plays a central and, in many cases, dominant role in both the planning and implementation activities. With the exceptions of the Forest Industry Renewable Energy program and the Canada-P.E.I. Alternate Energy Development Program, the Division has not been as active in the market introduction and penetration phases. In fact, a sense of frustration has been expressed at the inability of the Division to influence market activity for specific new technologies. With this activity primarily in the hands of others (primarily manufacturers and suppliers of the PAT), much of this frustration is judged to be based on a lack of

understanding of the planning phase of the market introduction stage in particular.

For a PAT which has successfully been demonstrated, the planning for market introduction involves three separate, sequential planning stages: First, a champion for the PAT must be established within a business organization which can manufacture and supply the product. Next, the champion must convince the top management of the business that the PAT is worth pursuing, that is, that the PAT would fit into the long term strategy of the firm. Finally, a detailed business plan must be prepared that confirms the size and nature of the market opportunity and documents the R&D, manufacturing, marketing and financial plans associated with the introduction of the new product. Only when all three stages are complete and the business plan is prepared can commitments be finalized for the resources required to initiate market introduction.

3.2 Development of Technology Transfer Plans for a PAT

The development of a technology transfer plan for a PAT consists of the following steps:

1. Description of the Current Situation
   - Identification of principal players
   - Evidence of market opportunity (size of market, supplier viability, etc.)
   - Identification of stage in the commercialization process

- Identification of barriers to further commercialization (see Table 3-2 for examples)

2. Plan of Technology Transfer Activities

- Establishment of specific TT objectives (expected action from targeted players)
- Determination of most cost-effective mechanisms to reach objectives
- Preparation of budget and schedule

3.3 Role of Information Transfer

The TT mechanisms include a range of communications (or information transfer) initiatives which may be appropriate at different stages of the commercialization process. Thus, information transfer cuts across and is involved with the traditional BED interest in R&D, demonstration and market introduction/penetration support. Such communications activities can be informal, such as personal interactions of experts, or formal, such as the preparation of brochures or technical bulletins.

It is desirable that the conduct of each communications activity be organized through a "mini-plan" that "nests" within the overall TT plan for a technology application. The components of such a communications plan are outlined in Figure 3-3 and discussed briefly below:

i) Objective

Communication can inform (i.e., create awareness), persuade (i.e., change attitudes), or remind. The

Table 3-2

Examples of Barriers Affecting
the Stages of the Commercialization Process

Opportunity Identification	• Lack of information re available technologies in other countries • Lack of market needs analysis • Lack of cross-fertilization or brainstorming opportunities
R&D	• Complexity of research problems • Lack of interest in conducting R&D • Insufficient funds or skills to conduct research • Market potential not defined • Monitoring/Analysis incomplete
Market Introduction	• Insufficient information available on which to base business strategy • Interest lacking • Resources (people, $) lacking • Impediments - regulatory and institutional
Market Penetration	• Lack of awareness - users • Lack of resources - manufacturers • Impediments - regulatory and institutional

Figure 3-3

Outline of Communications Plan for

Information Transfer Activity

i) Communications Objective(s)

ii) Target Audience(s)

iii) Basic Message and Supportive Information

iv) Media Plan

v) Production Considerations

vi) Evaluation Framework

vii) Budget

viii) Schedule

objectives of a communications plan should only be stated in one of these three ways.

ii) Target

The target audience(s) for the communication must be clearly identified.

iii) Basic Message

To ensure effective communication, the "message" to be communicated to the target must be distilled to its essence. Levels of detail of supportive information to be communicated (i.e., the evidence that supports the basic message) should be appropriate for the target group(s).

iv) Media

The most cost-effective vehicle(s) for reaching the target with the message (with sufficient frequency for the impact desired) must be identified.

v) Production Considerations

The materials must be produced to the quality level appropriate for gaining visibility and credibility with the target.

vi) Evaluation Framework

An evaluation framework should be established to judge the level of success in reaching objectives.

vii) Budget and, viii) Schedule

The schedule and budget commitments for the communications activity must be established.

4. STEPS TO DEVELOP A TECHNOLOGY TRANSFER PLAN FOR BED

Section 3 outlined the conceptual approach for establishing a technology transfer strategic plan for an individual potential application of technology (PAT) within the Bioenergy Division. The strategic plan for the BED as a whole consists of the rationalization of TT plans for selected technology applications to achieve the most efficient and effective use of BED resources. The basic steps required to develop a TT plan for the Division are outlined in Figure 4-1 and discussed below:

i) Establish Areas of Strategic Interest

The starting point is a briefing document prepared by BED management which establishes the strategic priorities for bioenergy commercialization. Such a document should have both a longer-term (10-20 year) as well as shorter-term (5-10 year) perspective. The brief should be based on statements of BED's policy directions, such as: i) Ensure near term take-up of bioenergy technology applications that are currently cost effective from the private perspective; and, ii) Ensure that prospective technologies will be proven to take advantage of opportunities offered by expected (or possible) changes in relative fuel prices by the mid-1990's. It should be noted that the approach to be taken for the preparation of the

Figure 4-1

Steps to Develop a Strategic
Plan for BED Technology Transfer

i) Establish Areas of Strategic Interest (BED Management)

ii) Document PATs Meeting BED Strategic Priorities (BED Officers)

- Description of the Current Situation (players, stage of commercialization, market opportunity, barriers)
- Preparation of the Preliminary Plan for TT Activities (objectives, activities, resources)

iii) Select PATs for Support (BED Management)

iv) Develop Detailed Plan of TT Mechanisms for PATs to be supported (BED Officers)

v) Prepare Information Transfer Plans (BED Officers and ITT Group)

strategic priorities brief is similar to that taken in the recently prepared "Strategic Plan for Bioenergy R&D".

ii) Document PATs Meeting BED's Strategic Priorities

On the basis of working knowledge of BED staff and experts, alternative bioenergy PATs are identified that are consistent with the strategic priorities. Extensive evidence of market prospects may or may not be available at this point. The PATs may be at different stages of commercialization and may be found in Canada or other countries. The market opportunity may be in Canada or other countries. For each technology application, the current source of the technology and the ultimate recipients (i.e., energy users) should be identified.

For each prospective application of technology deemed to be of strategic interest, the relevant marketplace must be described, with key players identified in each category (research institutions, manufacturers, delivery agents/facilitators and potential customers). The current stage in the commercialization process for the PATs must also be identified.

From the description of the current situation, the critical barriers holding back a desirable rate of commercialization can be identified. Appropriate BED TT objectives for the PAT can be established in terms of the reduction or elimination of these barriers.

Alternative TT mechanisms can be assessed to determine the most effective approach for overcoming barriers. Resource requirements can be identified.

iii) Select PATs for Support

The alternative PATs must then be assessed by BED management and ranked in terms of priority for BED support. Criteria for ranking would include the timing and extent of the potential market impact, level and type of risks associated with overcoming barriers and consistency of support with national energy policy objectives.

iv) Develop Detailed Plan of TT Mechanisms

An implementation plan for each accepted PAT can then be prepared by the appropriate BED officer to finalize plans for the TT mechanisms which would be most cost effective in addressing the barriers.

v) Prepare Information Transfer Plans

Based on the finalization of the TT plan for the Division as a whole as well as plans for individual technology applications, the information transfer requirements can be identified. As mini-plans are developed for each such requirement, opportunities for coordination and efficiency of execution can be identified and an integrated information transfer plan prepared. This planning activity for information transfer requires coordination between the BED project officers and the ITT Group within the Division.

5. IMPLICATIONS FOR IMPLEMENTATION

In this project, it was determined that the development of a strategic plan for information and technology transfer for the Bioenergy Division is synonomous with the planning process for the Division's overall set of activities. Information and technology transfer were found to be integral to, and not an adjunct to, execution of the mission of the Division.

Incorporation of the approach to strategic planning recommended in this report necessarily involves the participation and support of all BED staff and not just the Information and Technology Transfer Group. Through a systematic approach to planning, priorities can be established, trade-offs recognized, and commitments made with an explicit picture of expected outcomes and management commitments. The recommended planning process is not intended to create additional responsibilities. Rather, it is intended to enhance the ability of BED managers to carry out their most critical responsibility -- the creation of a clear and comprehensive sense of direction for the Division that leads to greater efficiency and effectiveness of day-to-day operations.

If accepted, the planning process outlined here must be introduced in an appropriate way to achieve understanding and support of those involved. The following sequence of steps is recommended:

i) Review/approval by BED management

ii) Review/approval by REB management

iii) Preparation of an Implementation Plan

iv) Presentation of the Implementation Plan and discussions with BED staff

v) Development of the BED Strategic Priorities brief

vi) Preparation of PATs (on a sequential basis as resources permit)

vii) Selection of PATs for Support

viii) Finalization and Implementation of TT Plans for PATs

The resource implications of the recommended planning approach are two-fold. On the one hand, the planning process forces rationalization of plans to meet approved resource levels. On the other hand, however, the planning process may identify priorities not fully recognized to date (such as the need for greater market development promotion initiatives). In this case, the planning process would bring forward the rationale for increasing or reallocating BED resources in the EMR policy development and budgeting process.

Appendix 1

Sources of Information

1. Studies and Reports Within Energy, Mines and Resources Canada (Listed by Title)

   Strategic Plan for Bioenergy R&D, Bioenergy Division, Renewable Energy Branch, Energy, Mines and Resources Canada, January, 1987.

   An Overview of Achievements in Bioenergy Research, Development and Demonstration, Passmore Associates International, Ensyn Engineering Inc., February, 1987.

   Renewable Energy Branch Presentation to the National Advisory Committee on Bioenergy, Renewable Energy Branch, Energy, Mines and Resources Canada, November 26, 1986.

   An Evaluation Framework for Renewable Energy R&D, McDaniels Research Ltd., Quantalytics Inc., July, 1986.

   Accomplishing Effective Energy Management Technology Transfer, J.E. Smith, Policy and Coordination Division, Energy Conservation and Oil Substitution Branch, Energy, Mines and Resources Canada, September 9, 1983.

   Enerdemo-Canada Evaluation Framework, Bureau of Management Consulting, March, 1985.

   Strategic Assessment of the Potential for Commercialization of Renewable Energy Technology in Canada, Phase I Report (Draft), James F. Hickling Management Consultants Ltd., November 15, 1984.

   Commercialization of Solar Energy: A Review of Barriers, Incentives and Policy Instruments, Bureau of Management Consulting, January, 1983.

2. Pertinent Studies from Literature Search (listed by title)

   Guidelines for Technology Transfer Planning, prepared for CE Technology Transfer Working Group, U.S. Department of Energy by Arawak Consulting Corporation, April 20, 1984.

   Technology Transfer for DOE's Office of Building and Community Systems: Assessment and Strategies, Oak Ridge National Laboratory, July, 1986.

Final Report on Biomass Technology Transfer Studies, Southeastern Regional Biomass Energy Program, Tennessee Valley Authority, May 31, 1985.

Development of a Strategic Technology Transfer Plan for DOE's Active Heating and Cooling Division, prepared for Active Heating and Cooling Division, U.S. Department of Energy by W.T. Chen and Company, Inc., April, 1984.

3. Interviews with Other Government Departments

Department of Regional Industrial Expansion

National Research Council

Science Council of Canada

Ministry of State for Science and Technology

4. Interviews within Bioenergy Division

Mr. Allan Dolenko, Director

Mr. Doug Hayes, Manager, Bioenergy Development Program

Mr. Bill Lowe, Manager, Information and Technology Transfer

Mr. Subhash Juneja, Coordinator, Industrial/Commercial

Mr. Ian Flann, Coordinator, Residential

Mr. Jay Barclay, Chief, Economic and Policy Analysis, Program Development and Coordination Division, Renewable Energy Branch

Appendix 2

Examples of Commercialization

Models in REB Studies*

1. "The Process of Development of an Innovation", Figure 1-1 taken from Commercialization of Solar Energy: A Review of Barriers, Incentive and Policy Instruments, Bureau of Management Consulting, January, 1983, page 3.

2. "Simplified Technology Development Process", Figure 2 taken from Strategic Assessment of the Potential for Commercialization of Renewable Energy Technology in Canada, Phase I Report (Draft), James F. Hickling Management Consultants Ltd., November 15, 1984, page 19.

* The figures referenced are reproduced on the following pages.

Appendix 3

Three Technology Transfer Models*

User-Oriented Model

The user-oriented TT approach is associated with programs where a particular energy user group has been selected as the focal point. Effective TT efforts require an understanding of the needs and decision processes of the user group. Then, the most appropriate cost-effective conservation and renewable technologies can be identified to meet the needs and initiatives taken to overcome the barriers holding back their adoption. The EMR Canadian Industry Program for Energy Conservation is an excellent example of a user-oriented TT approach.

Deliverer-Oriented Model

In the second approach, the pivotal player is the delivery agent. In this model, delivery agents are able to offer a variety of products and programs to a variety of energy user groups. The role of Conservation and Renewable Energy Offices (CREO's) can be seen as an example of the delivery agent TT approach, through which the adoption of available technology applications is expedited. The CREO's work with a broad range of user groups and promote a broad range of conservation and renewable energy technologies. A second example of the TT approach is found with the Prince Edward Island Energy Corporation (PEIEC). This group has played a central role in

* Based on "Guidelines for Technology Transfer Planning", prepared by Arawak Consulting Corporation for the U.S. Department of Energy's conservation and Renewable Energy Technology Transfer Working Group, 1984.

expediting the take-up of several renewable energy technologies to a range of energy users, including schools, farms and commercial enterprises.

Product-Oriented Model

The third technology transfer approach can be called the "product-oriented" approach. As stated on page 19 of the U.S. Department of Energy report prepared by Arawak Consulting Corporation: "The objective of the product-oriented technology transfer model is to transfer a technology, product, process or body of focused information whose application will result in greater energy efficiency or increased use of renewable energy." The product-oriented approach is used when the opportunity for a specific technology application has been identified and the commitment made to accelerate its development, availability and adoption.

There are two phases of technology transfer in the product-oriented TT approach. In the first, development of the technology application is taken through the research and development stages to the point where manufacturers make commitments to produce and market the product. In the second phase, the technology is adopted (i.e., produced and installed) among the target group of energy users. Through these two stages, the TT efforts may be directed at researchers, manufacturers, facilitators, delivery agents or user groups. The purpose of all these efforts, however, is single-minded: To promote the adoption of a specific technology application.

Appendix 4

Transfer Mechanisms: Characteristic Advantages, Disadvantages, and Appropriate Situations for Use

CHANISMS	ADVANTAGES	DISADVANTAGES	APPROPRIATE SITUATION
SUBCONTRACTS AND COOPERATIVE R&D	- Early interaction with private sector - Reduces private sector risk - Rapid technology transfer - Gains access to enhanced resources - Overcomes "not invented here" syndrome	- Potential interference with private sector - Potentially discriminatory to competing companies	- Government and industry goals and needs match - Technology is feasible, yet untested
DEMONSTRATIONS	- Provide evidence of technical and financial viability in actual applications	- Applications may not be representative - Location may not be accessible to targets for replication	- Technology proven in lab, pilot situations
INDUSTRY ADVISORY COMMITTEES	- Promotes government/industry communication - Provides R&D direction - Inexpensive - Easy to administer - Can be helpful as program advocates	- Vulnerable to special interest pressures - Vulnerable to conflicts of interest - Proprietary interests may discourage information sharing - Non-proprietary information sharing may discourage product development	- As stages of technology development

Appendix 4 (Cont'd)

MECHANISMS	ADVANTAGES	DISADVANTAGES	APPROPRIATE SITUATION
- TECHNICAL REPORTS AND PUBLICATIONS IN PROFESSIONAL JOURNALS, TRADE MAGAZINES	- Tangible, permanent documentation - Can be tailored to an identified audience - Inexpensive	- No personal contact	- Addressing scientific and practitioner communities throughout the stages of technical development - When a specific problem/solution has been identified
- NEWS RELEASES	- Reach wide-spread audience	- Likely to be superficial	- There is a need to generate awareness audience quickly
- GUIDELINES AND STANDARDS	- Adds credibility to new products - Provides basis for comparing products	- Lengthy time to establish - Outdated standards may inhibit use of new technologies	- Individual evaluation of products is difficult - Well developed technology that has not yet gained public acceptance
- TAX INCENTIVES/ LOAN GUARANTIES	- Reduces private sector risk - Enhances private initiative	- Potential loss to Treasury - May raise interest rates - Secondary effects may outweigh intended effects	- Well developed technology that has not yet gained public acceptance

Appendix 4 (Cont'd)

MECHANISMS	ADVANTAGES	DISADVANTAGES	APPROPRIATE SITUATION
- TECHNICAL ASSISTANCE/ EDUCATION/ TRAINING	- Direct and immediate - Promotes second generation technology transfer - Can achieves long-term behavioral change	- Highly selective - Expensive	- There is a Nationally recognized need - Complex information needs to be conveyed and illustrations/ demonstrations are essential.
- VIDEO TAPES	- Highly informative - Reach wide audience - Flexible use - Easily edited and updated	- Must establish a distribution network - Expensive	- Complex information needs to be conveyed and illustrations/ demonstrations are essential
- COMPUTER SOFTWARE AND OTHER DECISION TOOLS	- Simplifies the communication of complex interruption	- Necessary computer software to develop - Training may be necessary	- Complex information needs to be considered in decision-making in order to generate demand for energy-efficient technologies
- COMPUTER NETWORK	- Rapid information exchange	- Necessary computer hardware may be expensive to purchase	- An ongoing exchange of technical information is necessary
- BANKS OF ENERGY PERFORMANCE DATA	- Interagency and international capabilities - Easy access to information	- Passive, must await requests - Can be inaccurate or incomplete - May not be current	- When a technology is at an active R&D stage and further development is dependent on data assimilation and analysis

Appendix 4 (Cont'd)

MECHANISMS	ADVANTAGES	DISADVANTAGES	APPROPRIATE SITUATION
- INFORMATION DISSEMINATION CENTERS	- Provide responses quickly "on demand" - Referral services may be available - Easy access to information - Tailored responses to specific questions	- Typically passive, must await requests - Quality dependent on collection and currency	- Addressing broad large audiences at later stages of technical development
- EDUCATION/ TRAINING	- Broadens understanding of energy management opportunities - Enhances day-to-day operating efficiency	- Danger of "one-shot" sessions with no follow-up - Difficult to implement coordinated program	- Ongoing with management and staff at energy using facilities
- DIRECT MAILING (Newsletters, Information packets, brochures, fact-sheets)	- Effective in generating awareness - Reach widespread audience - Rapid receipt of message - Information dissemination does not require major user effort	- Communication is not interactive and runs the risk of not providing desired information - Depth of information covered tends to be limited by the format	- There is a need to generate awareness by a broad audience quickly
- RADIO/ TELEVISION ANNOUNCEMENTS	- Reach a wide audience - Report receipt of message	- Impact is likely of short duration - Expensive - Likely to be superficial - Ineffective in changing strongly held attitudes	- There is a need to generate awareness by a broad audience quickly

Appendix 4 (Cont'd)

MECHANISMS	ADVANTAGES	DISADVANTAGES	APPROPRIATE SITUATION
- WORKSHOPS/ SEMINARS/ CONFERENCES	- Inexpensive - Assembles key decision makers - Promotes discussion, interaction	- Difficult to follow up	- All stages of technology development. The smaller workshops and seminars lend to be most useful for specific topics. Conferences are most useful for subjects with broad appeal.
- PERSONNEL TRANSFER TO/ FROM INDUSTRY	- No training lag - Minimal agency effort or expense - Shared costs and risks	- Possible loss of key personnel - Subject to availability of personnel - Short-term loss to agency/ industry - Cost of administrative arrangements	- Information exchange requires extended personal interaction - Inventor can assess in implementation/manufacture of a new technology
- VISITS TO/FROM INDUSTRY	- Key actors meet one-to-one - Inexpensive - Promotes personal interaction - Rapidly accomplished - Technical dialogue excellent	- Highly variable pay off	- Technology is visible or impressive and key actors need convincing - All stages of technology development
- MARKET ASSESSMENTS	- Provide evidence of prospective opportunity (size and nature of market requirements, competitive advantages, supplier marketing strategies)	- Little "hard" data at early stages - Inexperience in preparation and interpretation	- All stages of commercialization - More extensive when move to introductory stage